Korea-Europe water management experience. Same water, different needs other technologies

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Korea experience

My name is Francesc Cervos, I am 27 years old and I come from Barcelona in Catalonia (Spain). I got a bachelor in civil engineering in the Polytechnic University of Catalonia (UPC) in Barcelona in 2005, and I combined my Master studies in Water Engineering, with a job in an engineering office since 2006.

I got the opportunity to come to Korea to take part in some courses to finish my Master course, so I arrived in Korea in March and will stay here till September, taking part also in Hydroasia, which will be held in Incheon in August.

I had a different idea about Korea before I arrived. Actually, not many news about Asia circulate in Spain so, even if a lot of international companies and high technologies come from here, is not easy to get an idea about it. So that first vague idea caused me to be surprised just by landing in Incheon Airport. Just looking at one of the most modern airports in the world, and the growing landscape of iFEZ gave me an idea of the country I had just came in.

After some months I can say that, for me, Korea is a country that looks always in movement, growing, modern but with a traditional culture, also in evolution. Most of the people I have met are really kind, even if sometimes the communication is a bit difficult (English is not my mother tongue either).

I did not know about Korean food before I came, so it was also something surprising. I discovered a lot of kinds of unknown food (for me), as the typical (now) kimchi for example, and all the spicy dishes. Sometimes it is really good, sometimes a bit weird, most of the times spicy, but it is always good to discover new tastes. It is amazing how I got used to Korean food, in fact, I love kimchi, and I will miss some dishes.

Recently I got the opportunity to travel around Korea. Even if the size of the country

is not huge, a incredibly amount of nature, different cities, amazing landscapes and indescribable food is in it. From Seoul to Jeju, from Busan to Sokcho, contrasts between urbanity and virgin nature, crowded and empty beaches, muddy ones, clear water, surprising parks…

It is always interesting to live somewhere for some time. I think that Korea is an interesting country, and it is easy to learn things, because there are really different concepts. Personally I think that there are also a lot of cultural differences to share. So that is basically why I was motivated to come to Korea. In an academic and professional point of view, it is known that some Asian countries are developing a high technology society, in the point that experience and development run together to find better and more efficient solutions for lifetime, and, of course, for engineering tasks. Those are, in my opinion, big motivations to come, and to learn how many differences are in the same topic, to discover and understand the concepts and ideas that each concept have behind.

Water resources management

In water engineering is possible to classify in a grosso modo two general problems. One is water protection, or flood control, and the other is water supply. Concepts that I include in water supply are ecological flows, irrigation and water quality. Both problems are included in the concept of water resources management (or Integrated Water Resources Management in a global view including all the uses); indeed, they used to be in the same system (even if specific tasks can be organized separately). Other concepts as energy and navigation may be included in water resources management depending on the priorities of use or rights.

It is worldwide known that water resources management itself, as a concept, has thousands of definitions, and it is also known that there is not a guide for any of them. Therefore, each water organization is applying its own procedures, and policies to deal with the society's water needs and the regional natural water resources. Even if some policies or systems can be adopted from other regions of the world, water needs and, of course, natural water resources can be, indeed, substantially different. Due to that fact, Europe in general and Korea share the same water problems (floods and shortages), but not in the same way (temporally) and not applying the same solutions.

European Union countries share the same water framework under the European Water framework directive since 2000 (2000/60-CE). This framework defines an integrated water management based in basin management units, and limits in water quality in rivers. It has the objectives to preserve, conserve and improve water quality and healthiness of river ecosystems. Even though, while in the northern countries more problems are related to flood control, southern countries often suffer of shortages (due to Mediterranean climate). Since the 90's, European countries have been sensibilized about environment

conservation, so soft measures (basically policies) are used to regulate water resources.

Korea has 4 main river basins. The longest rivers discharge to the southern and western coast, stretched and with a mild gradient, Han, Nakdong and Geum River have in their basins a population of about 30 million.[1] Other rivers discharging to the east coast are short in length and steep.

One of the particularities of Korean water resources is the rain yearly distribution. In Europe, in general, there are 2 rainy seasons, during spring and at the beginning of autumn, while in Korea the majority of the rain happens during summer. This fact increases the difficulty to manage the water stored in the reservoirs, specially when flooding problems can occur, since the biggest dams are multi purpose.

On the other hand, water needs are also different between Korea and Europe. Actually, Europe, has dotations (depending on the country) going from 250 l/pers/day in the south to 350 L/pers/day in the north, and consumptions from 125-380 l/pers/day. Those dotations are vary depending on the water needs, the policies, the historical resources, and the alternative and improvement of the water sources. In Korea, the average household consumption is about 186 l/pers/day[2], so the needs are average compared to Europe, but the irregularity of the natural resources makes a complex mission to achieve.

While in Europe actually flood control and water management is in an integrated basin system, Korea has an organism for flood control, and some other organisms for other water uses. Also the decisions about water uses rely on different governmental ministries, so the decision making process may be, in some cases, difficult. Even though, a complete high technology model based system is used nowadays, to make optimum operations in the water systems.

As far as I have learned, Korea has a complete integrated decision support system (DSS) of models that include inflow forecasting module, routing module, and water management models (also with water quality modules) for and optimization of daily operations. The DSS is applied in Geum River and Han River, and it is operated by K-water. An optimization algorithm is used to estimate the outflows of the reservoir operated by the public company. Also the flood control centre has a DSS to estimate the short term operations to minimize flooding events.

Personally, I know that in most of the Spanish water basin management units those technologies are not used. Most of them have some models for some operations, but other operations are based only on the experience of the operators. For mid and long-term planning, in those water basins they are starting to use simulation models, but most of the measures are based on decrease of water demand or change of water sources (use of alternative water sources such as recycled water or desalination) to improve the future

1) Water Resources in Korea 2005. Ministry of construction and transportation.
2) OCDE 2008

water supply warranty.

Personally, I think that the model based pn short, mid and long-term operations, has a direct positive impact on water management, thus they became useful tools for ordinary operations. Even though, mid and long-term planning needs of experience about the system itself, and an idea of the desired development of the regions, to estimate water demands. Nevertheless, modeling of water management systems is useful and a real important tool, to test policies and new infrastructures.

Finally, I would like to mention about the Four River restoration project. The fact of acting in the mainstream of the principal rivers and an investment of 19 billion USD in 3 years is information simply difficult to imagine. Actually, after seeing the dimensions of the country, it even looks more incredible, but studying the flood damages, restoration and expected benefits in the environment it looks as a reliable project, and I think it is only possible to make it in 3 years a country like in Korea. Actually, among other actions (as dragging and new embankments) there is the construction of 16 new weirs in the river.

The 4 river restoration project is based on 5 main objectives: improvements water storage, protection against floods, water quality and ecosystem, creation of public spaces and a river oriented community development.

I think that the idea itself goes in the right direction. But, personally, I would like to give some comments about it, most of them are reflections of different people that knows much more about the project and Korean reality and which opinions I share. For one side, against the non-ore-dams-movement (it exist also in Europe, where it is not negotiable to plan a dam), smaller weirs have been planned. The volume stored in those weirs, will make the water management system more complex, and the volume stored is not going to be big enough to become a solution for a drought situation.

Even though, flooding control will be easier, indeed with more points of water retention, discharge peaks will be reduced so water levels are going to be lower. Probably, with the control of non-point contamination sources, by protection of waterfronts or other measures, water quality will be improved. What I personally do not understand is about a possible improvement of the ecosystems when the water flow regime is modified, as it is known, after a construction of a dam, a complete ecosystem in the reservoir area is modified, breaking the natural equilibrium because, between other effects, the natural river flow is lost. So I wonder how all the actions can affect the river ecosystem with those suppositions.

Finally, I would like to mention the ambitious schedule for such a huge plan. Maybe if it could be developed in 20 years instead of 3, some possible mistakes could be restated if effects result to be non desirable. Big projects have always detractors and defenders, and only the future will show what was the proper decision to make.

Korean water resources management has been a new concept for me, from the characteristic natural resources, to the high

technology planning and operations passing through its water needs and priorities. Actually, I am sure that I learned a different way to understand water problems, in a country in which water is a problem for too much and too less, and which water policy evolution will improve much more its efficient water management.